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## LABORATORY NOTES

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By E. B. TITCHENER

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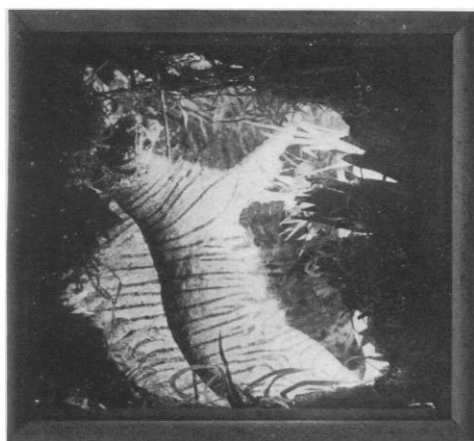
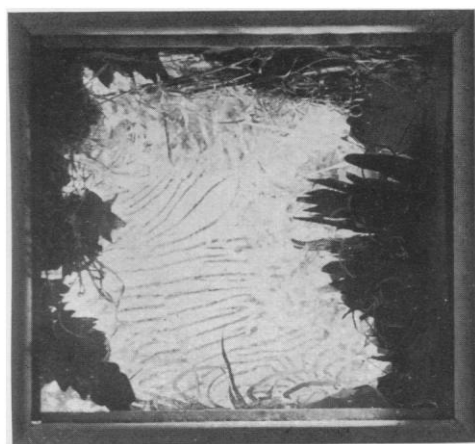
### I. THE INDIAN HARMONIUM

In view of the present interest in primitive and exotic music, it may be worth while to call attention to the Indian (Hindu) Harmonium manufactured by Messrs. Moore and Moore, New Oxford Street, London, at the price of twenty pounds. Style and finish are like those of the Ellis Harmonical, made by the same firm; instructions for tuning are furnished, so that the possible effect of the journey upon intonation need not be feared. The harmonium, designed with Mr. K. B. Deval's assistance by Mr. H. K. Moore, is fully described in a recent work by E. Clements,—*Introduction to the Study of Indian Music*, Longmans, Green & Co., 1913, \$2.00 net. A more technical account is given in *Specifications of Inventions*, etc., 1911, lxxviii. (London, Patent Office, 1913), under no. 15548. Every octave has 23 notes, giving the 22 srutis or degrees of the Indian scale, with one additional note for modulation; the 11 extra notes are played by pressure upon studs which pierce the black and white manuals. The instrument is of great value both for class-room demonstration and for research.

### II. A THAYER TIGER

Readers of A. H. and G. H. Thayer's *Concealing Coloration in the Animal Kingdom* (this JOURNAL, xxi, 1910, 500 ff.) will remember the plate of the jaguar seen upon a background of forest leaves, and the photographs of the cardboard zebra against reeds and straws (pp. 132, 138), which illustrate typical obliterative picture-patterns of countershaded mammals. These plates are sufficiently striking, even though the animals appear in the flat, and even though the fixity of the camera-lens and the absence of color in the photographs make against obliteration.

The disappearance of the real animal into its background, under favorable conditions of illumination, is wonderfully shown by the model here pictured. The model, built by Mr. A. H. Thayer, is that of a tiger posed amidst long grass and seen against a grassy background. The two photographs were taken by the same camera, with no change of circumstance other than the shift of illumination. In the left-hand figure, the tiger stands out, solid and substantial, light and dark, just as it might be seen upon the floor of a menagerie cage; the lighting is due to three electric bulbs, two below and one to the right of the model. In the right-hand figure, in which the lighting simulates that of direct sunlight, the animal has lost solidity, has become amazingly transparent, and merges as a color-pattern into the background. An observer who views the change in an otherwise darkened room, at a distance of some 15 m., from a point squarely in front of the model, will literally lose the tiger for some ten seconds; with monocular vision, he will lose it for a longer time. No doubt, the sudden increase in the intensity of light aids this disappearance,—though it must be



remembered, on the other side, that the animal stays in place and that its contour is well-known when the change occurs. If the sunlight-effect is shown first, to an untrained observer, minutes may elapse before the tiger is made out; when it is made out, certain details (especially of neck and head) may be erroneously interpreted; and it is judged, when found, to be painted on glass and not modelled in the round, so that the assumption of solidity when the switch is turned comes with a distinct shock of surprise. I am more impressed, however, by the magnitude of the change when observed with full knowledge of lighting and construction.

The model has been set up permanently in the demonstrational laboratory of our Department of Psychology. It is the first model that Mr. Thayer has built for public exhibition. President Sanford and Professor Yerkes, who have seen it, join with me in the wish that its author—or some young artist of competence working under his direction—might be enabled to prepare similar models for the principal psychological and biological laboratories of the country.

### III. THE HOLMGREN WORSTEDS

I have examined a number of sets of the Holmgren Worsteds, as supplied by various dealers, and find that they differ very considerably. Holmgren himself (*Om Färgblindheten*, Upsala, 1877, p. 135) mentions as his authorized agent Frl. Letty Oldberg of Upsala. Frl. Oldberg still supplies the worsteds; and though they differ a little from the standards shown in Holmgren's colored plate, they agree more closely with these originals than does any other set that I have seen, while the differences are such as might be expected on the hypothesis that the colors of the plate are somewhat faded.<sup>1</sup>

The Holmgren test is so rough that the diversity of the sets found on the market probably makes very little difference in the results, provided that there is a sufficiently full series of skeins for comparison. For this reason I do not think it worth while to enter into particulars. Since, however, the test is still widely used, and since the educational importance of holding to a standard can, in general, hardly be overestimated, I have advised the C. H. Stoelting Co. to import the Oldberg series, and to supply it to all psychological and educational laboratories which order the "Holmgren Worsteds." Mr. Stoelting will furnish these authorized sets as soon as they can be procured.

### IV. THE HERING GREY PAPERS

The set of 50 Hering grey papers has not proved satisfactory.<sup>2</sup> Aside from the fact that many sheets are tinged with color (a fact to which I called attention in *Experimental Psychology*, I, ii., 1901,

<sup>1</sup> The plate is reproduced in J. E. Jennings' *Color-Vision and Color-Blindness*, 1896, frontispiece, and in *Report of Royal Society Committee on Color-Vision*, 1892, facing p. 96. In the examples that I have seen, the reproductions differ both from each other and from the Holmgren original.

<sup>2</sup> I authorized the C. H. Stoelting Co., in 1902, to import these papers. I was not, as I need hardly say, responsible for the form of the advertisement in the firm's circular of that year. The advertisement was written with a too confiding trust in the statement of the German manufacturer.

32), the numbered series is often markedly uneven. The Leipzig manufacturer, Herr Mitter, sends the following information:

"Where the divergent shades occur, you have to do with a remanufacture of particular numbers. The reason is this: particular numbers are often ordered from the series, while the less used numbers remain in stock. Then, in order to make the series complete, the numbers that have been sold out are manufactured afresh. It is, unfortunately, impossible exactly to reproduce the original shades; a minute difference always appears; and though this difference may be hardly noticeable in itself [that is, I suppose, when the two papers, the new and the old are compared], it does show faintly in the series."

I have no doubt that this explanation is correct; and it is readily conceivable that, without a more careful process of manufacture than the demand for these papers and the price at which they sell now warrant, some unevenness is inevitable. I must add, however, that Herr Mitter seriously understates the defects of the series. His letter goes on to say that he has received no complaints from his German customers; and yet Hering himself wrote in 1907 (*Lehre vom Lichtsinn*, 83): "The series of grey papers prepared commercially at my suggestion unfortunately leave much to be desired."

The C. H. Stoelting Co. has gone carefully over its stock, regrading and renumbering; and Herr Mitter undertakes in future "die Differenzen auszugleichen, so gut es technisch möglich ist." But, when all is done, unevenness will remain; and it should be understood that a reference to "Hering grey no. so-and-so" indicates only approximately the grey actually employed. The papers are exceedingly useful; they cannot, however, be relied upon as standards.

#### V. THE HERING INDIRECT-VISION COLOR-MIXER

Certain passages in Rand's *Factors that Influence the Sensitivity of the Retina to Color* (1913, 56) give the impression—so it seems to me and to other readers whom I have questioned—that the Hering Indirect-Vision Color-Mixer was designed not by Hering but by Hess. It is hardly likely that the writer fell into this mistake; but since some unwary student may be misled, I take this occasion to point out that the instrument has always been ascribed to Hering in Rothe's catalogues, and that Hess himself puts the matter beyond question (*Arch. f. Ophthal.*, xxxv., 4, 1889, 25) by the remark: "Diesen Forderungen wurden in der folgenden Weise mit Hilfe eines von Herrn Professor Hering angegebenen Apparates erfüllt."

Rand asserts in a footnote that my *Exp. Psych.*, I., ii., 1901, 20, "ascribes the description of this apparatus to Hering, giving as reference A. f. O., 1889, xxv., 4, p. 63." I do not, however, ascribe the description of the apparatus, but the apparatus itself, to Hering; and my reference is not xxv. but xxxv. In the article to which I refer Hering mentions the "nach neuen Methoden angestellten Versuche" of Hess, with a foot-note reference to Hess' own paper; and Hess (p. 2) speaks in like language of the "neuen von ihm [Hering] angegebenen Untersuchungsmethoden." The *Sachlage* is surely clear enough. Rand fails to state that I mention Hess on p. 26.

#### VI. THE HERING COLOR-BLINDNESS APPARATUS

The original description of Hering's apparatus for testing color-blindness (figured in my *Exp. Psych.*, I., ii., 1901, 7) speaks of "eine dem Apparat beigelegte Anweisung," a set of directions for the adjust-

ment of the instrument in order to the performance of a test without waste of time. This *Anweisung* has been mentioned in various dealers' catalogues. There seems to be a reference to it in Spindler and Hoyer's large Catalogue XXI. (preface dated 1908). "Mit dem Apparate," we read, "wird eine Beschreibung nach Hering mitgeliefert, in welcher angegeben ist, welche Farben man zu wählen, und wie man bei der Herstellung der Gleichung zu verfahren hat" (p. 69). But this sentence may refer, on the other hand, simply to Hering's account excerpted from the Arch. f. Ophthal., which was formerly supplied by Rothe, and in which—to be sure—the apparatus is described, but which also contains the primary reference to the elusive *Anweisung*.

At any rate, I have never been able to secure the set of directions in question, although I have made enquiry of a number of colleagues, have written to Professor Hering himself, and have asked the principal dealers (Spindler and Hoyer included) whether copies were available. If any reader of this JOURNAL happens to possess the *Anweisung*, I shall be grateful for the loan of it, and will undertake, with the owner's permission, to reprint it. There is no particular difficulty in the use of the instrument, provided that "man sich auf den Standpunkt der Theorie der Gegenfarben stelle"; but uniformity of procedure is none the less desirable.

#### VII. DEMONSTRATIONS OF COLOR-BLIND VISION

Various attempts have been made to indicate by colored diagrams the appearance of familiar objects as seen by the partially color-blind. (1) The Report of the Royal Society's 1890 Committee on Color Vision, 1892, prints, facing p. 4, a plate of 5 spectra, normal, green-blind, red-blind, violet-blind, induced by disease. The plate is signed W. de W. A[bney]. (2) A similar plate, signed with the same initials and prepared by the same lithographer, but printed with right-left conversion, forms the frontispiece of W. de W. Abney's *Color Vision*, 1895. In the copy belonging to the Cornell University Library *blue* is entirely absent; I should say, from the general freshness of the plate, that, by an oversight, the blue pigment had never been applied. (3) The frontispiece of E. W. Scripture's *Thinking, Feeling, Doing*, 1895, shows the American flag as seen by most people, by red-blind persons, by green-blind persons, by violet-blind persons, by totally color-blind persons. In the edition of 1907 this plate has been suppressed, though a table on p. 136 tells how the flag appears to trichromats, dichromats I, dichromats II, green-blind, red-blind, blue-blind, and monochromats. (4) In W. F. Norris and C. H. Oliver, *System of Diseases of the Eye*, ii., 1897, W. Thomson and C. Weiland print four colored spectra (facing p. 315): that of the normal eye, a combined spectrum of potassium, lithium, sodium, thallium and caesium, that of the green-blind and that of the red-blind person. (5) In *The Century Magazine* for April, 1907 (lxxiii., 882 ff.) E. A. Ayers has colored plates of roses and leaves as seen by normal, red-blind and green-blind eyes; of three shades of red, green, violet as seen by three classes of color-blind; and of a Venetian scene as it appears to normal eyes and to a person partially color-blind in red. (6) There are colored plates of spectra, again, in Abney's *Researches in Color Vision*, 1913. Plate I (facing p. 275) shows, according to its legend, "spectrum colors as named by persons who were completely or nearly completely red or green blind," or shows, according to the text (p.

275), "how the completely red blind," for instance, "sees the spectrum."

All of these charts—and there are doubtless others that I do not know—are in one way or another misleading, whether the mistakes are due to theoretical bias, to the difficulties of color printing, or to sheer ignorance.<sup>3</sup> Yet it is distinctly of advantage to have demonstrations of the spectrum of the partially color-blind (ordinary red-green blindness, the blindness of the deuteranope or "green-blind," and the less common red-green blindness of the protanope or "red-blind"): the demonstration *ad oculos* is convincing, and saves the lecturer's time. I have therefore had two large spectra painted in oil by Mr. L. A. Fuertes; the canvases, about 150 by 20 cm., were first marked off roughly, at half-a-dozen points, for the principal colors, then subdivided for more accurate work into 35 or 40 strips of equal breadth, and then colored as quickly as possible from an already prepared palette. The yellow-series offers considerable technical difficulty; aside from questions of tint and chroma, it is exceedingly difficult to rule out every hint of green. General surroundings make more difference in this regard than even the trained eye would suspect,—so that a spectrum which appears greenless in the studio may show a faint wash of green when hung upon the wall of the lecture-room. This fact makes me hesitate to undertake the preparation of these spectra for others. Our own pair are excellent in our surroundings, and so long as Mr. Fuertes' services are available can be duplicated, in wide black frames, for about \$25 apiece.

#### VIII. A DEMONSTRATION OF "TIED IMAGES"

I owe to Dr. W. S. Foster the suggestion that the pictures of Coles Phillips are useful for the demonstration of "tied" visual images. In particular, the young lady who is on her knees before a box of silver has been reproduced on a large scale for advertising purposes. Deprived of the silver (the unkindness is justified psychologically, because the box gives the outline of her knee), and pasted upon a dead-black background, she is an instructive figure; the observer "sees" a great deal that is not there to be seen; and the imaginal vision is, so far as our experience goes, practically uniform at certain points ("tied" imagery), and extremely variable at others.

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<sup>3</sup> C. L. Franklin, *Science*, xxv., 1907, 746.